AMENDMENT NO. 2 APRIL 2022

TO

IS 4984 : 2016 POLYETHYLENE PIPES FOR WATER SUPPLY — SPECIFICATION

(Fifth Revision)

[*Foreword, para* 3, *Sl No.* (a), *fourth sentence*] — Substitute the following for the existing sentence:

‘Therefore, the Committee has decided to retain the present practice of manufacturing PE pipes with master batch technology for black pipes, in addition to manufacture by use of pre-compounded material.’

[*Foreword, para* 3, *Sl No.* (g)] — Substitute the following for the existing:

‘g) Carbon black content and its dispersion have not been specified for the raw material as PE resin in its virgin form has been permitted. In case of pre-compounded material, where used, a requirement for obtaining test certificate from the material supplier has been included.’

(*Page* 1, *clause* **2**) — Substitute the following for the existing entries for IS 4905 : 1968 and IS 7328 : 1992:

IS No.	*Title*
4905 : 2015/ ISO 24153 : 2009	Random sampling and randomization procedures (*first revision*)
7328 : 2020	Specification for polyethylene material for moulding and extrusion (*second revision*)

(*Page* 1, *clause* **2**) — Delete the entry for IS 10141 : 1982.

(*Page* 1, *clause* **2**) —Insert the following new entry at the end:

IS No.	*Title*
16738 : 2018	Positive list of constituents for polypropylene, polyethylene and their copolymers for its safe use in contact with foodstuffs and pharmaceuticals

(*Page* 2, *clause* **3.21**) — Insert the following new clause after the clause:

‘**3.22 Rework Material** — Material prepared from rejected unused pipes, including trimmings from the production of pipes, that will be reprocessed in a manufacturer’s plant by a process such as extrusion and for which the complete formulation is known.

(*Page* 2, *clause* **5.1**) — Insert the following at the end:

‘The various constituents used to make the material for extrusion shall meet the requirements specified in **5.2** to **5.5**.’

(*Page* 3, *clause* **5.2**) — Substitute the following for the existing clause:

‘5.2 Polyethylene Resin

5.2.1 PE resin used for the manufacture of pipes shall conform to parameters mentioned in Table 2. In addition, the resin shall conform to the requirements of IS 10146 and **5.5** of IS 7328.

The material classification and conformity to Table 2, **5.5** of IS 7328 and IS 10146 shall be provided by raw material (resin) manufacturer with documentation duly certified by the resin manufacturer.

Price Group 4

5.2.1.1 In case of pre-compounded black material, the PE resin shall meet the requirements in **5.2.1**. The other constituents used should be from the positive list of constituents of PE in contact with foodstuff and pharmaceuticals as per IS 16738 and should not constitute a toxic hazard, shall not support microbial growth and shall not give rise to an unpleasant taste or odour, cloudiness or discolouration of the water. The certificate for conformity in such a case shall additionally include the results of compound density, carbon black content, toluene extract, maximum volatile matter, carbon black particle size, ash content and carbon black dispersion to establish conformity to the requirements specified in Sl No. (i) of Table 2, **8.3**, Sl No. (2), (3) and (4) of **5.3**(e), **5.3**(d) and **8.3**, respectively.'

[*Page* 3, *clause* **5.3**(b), *line* 4] — Substitute 'IS 16738' *for* 'IS 10141'.

[*Page* 4, *Table* 2, *Sl No*. (i), *col* 4] — Substitute '940-960 (The tested value of density shall not differ from density declared/nominated by the resin manufacturer by more than 3 kg/m^3.)' *for* '930-960'.

[*Page* 4, *Table* 2, *Sl No*. (ii), *col* 4] — Substitute '0.15 to 1.1 (both inclusive)2) (The tested value of melt flow rate (MFR) shall be within ± 20 percent of the MFR declared/nominated by the resin manufacturer if the latter is 1 or above, and within ± 30 percent if the latter is less than 1)' *for* '0.2 to 1.1 (both inclusive)'.

(*Page* 4, *Table* 2, *footnote* 1)) — Insert the following new footnote at the end of table:

2) In case of materials with $0.15 < \text{MFR} < 0.20$, attention is drawn to the fusion compatibility which has to be established by the raw material supplier. The lowest MFR value resulting from the maximum lower deviation of the nominated value should be not less than 0.15. For $0.15 \leq \text{MFR} < 0.20$ compounds, fusion compatibility of larger diameter thicker-walled pipes should be investigated to confirm compatibility. If electrofusion jointing is to be adopted, appropriate testing should be carried out to verify the fusion capability of such pipes.

(*Page* 4, *clause* **5.4**, *line* 4) — Substitute 'IS 16738' *for* 'IS 10141'.

(*Page* 4, *clause* **5.5**) — Substitute the following for the existing clause:

'5.5 Rework Material

The addition of not more than 5 percent of the manufacturer's own rework material conforming to this standard is permissible. No other rework material shall be used.'

(*Page* 4, *clause* **6.1.3**, *line* 6) — Substitute '2 000, 2 250, 2 500 mm' *for* '2 000 mm'.

(*Page* 4, *clause* **6.1.4**, *Informal Table*) — Delete the entry for PN 3 from the table.

(*Page* 4, *clause* **6.2.1**, *line* 5) — Delete the term 'preferably'.

[*Page* 5, *Table* 3, *Sl No*. (xxxiv)] — Insert the following new entries at the end:

Sl No.	Nominal Size DN/OD	Nominal Outside Diameter, d_n	Mean Outside Diameter		Maximum Out-of-Roundness (Ovality)
			($d_{em, Min}$)	($d_{em, Max}$)	
(1)	(2)	(3)	(4)	(5)	(6)
xxxv)	2 250	2 250	2 250.0	2 270.3	-
xxxvi)	2 500	2 500	2 500.0	2 522.5	-

(*Page* 5, *clause* **7.4.1.1**, *Note* 2) — Substitute 'dispute' *for* 'discrepancy'.

(*Page* 5, *clause* **7.4.1.2**) — Substitute the following for the existing clause:

'Ovality shall be measured at 300 mm away from cut end, using a scale having suitable graduations/sliding vernier calliper permitting reading to the nearest 0.05 mm. For coiled pipes and straight pipes having SDRs ≥ 21, re-rounding shall be permissible before the measurement of ovality.

Ovality shall also be measured by the manufacturer during extrusion and prior to coiling and a record of the results obtained shall be maintained for inspection by the purchaser, wherever required.'

(*Page* 6, *Table* 4) — Substitute the following for the existing table:

Table 4 Standard Dimension Ratio (SDR) and Corresponding Wall Thicknesses (*e*) of Pipes

(*Clauses* 7.2 *and* E-4.3)

SDR ⟶	**SDR 41**		**SDR 33**		**SDR 26**		**SDR 21**		**SDR 17**		**SDR 13.6**		**SDR 11**		**SDR 9**		**SDR 7.4**		**SDR 6**	
Grade ↓	Nominal Pressure (PN) Bar																			
PE 63	**PN 2**		**PN 2.5**		**PN 3.2**		**PN 4**		**PN 5**		**PN 6**		**PN 8**		**-**		**-**		**-**	
PE 80	**PN 2.5**		**PN 3.2**		**PN 4**		**PN 5**		**PN 6**		**PN 8**		**PN 10**		**PN 12.5**		**PN 16**		**PN 20**	
PE 100	**PN 3.2**		**PN 4**		**PN 5**		**PN 6**		**PN 8**		**PN 10**		**PN 12.5**		**PN 16**		**PN 20**		**-**	
	Wall Thicknesses																			
Nominal OD, d_n mm (1)	e_{Min} mm (2)	e_{Max} mm (3)	e_{Min} mm (4)	e_{Max} mm (5)	e_{Min} mm (6)	e_{Max} mm (7)	e_{Min} mm (8)	e_{Max} mm (9)	e_{Min} mm (10)	e_{Max} mm (11)	e_{Min} mm (12)	e_{Max} mm (13)	e_{Min} mm (14)	e_{Max} mm (15)	e_{Min} mm (16)	e_{Max} mm (17)	e_{Min} mm (18)	e_{Max} mm (19)	e_{Min} mm (20)	e_{Max} mm (21)
16	-	-	-	-	-	-	-	-	-	-	-	-			2.0	2.3	2.2	2.6	2.7	3.1
20	-	-	-	-	-	-	-	-	-	-	-	-	2.0	2.3	2.3	2.7	2.8	3.2	3.4	3.9
25	-	-	-	-	-	-	-	-	-	-	2.0	2.3	2.3	2.7	2.8	3.2	3.4	3.9	4.2	4.8
32	-	-	-	-	-	-	-	-	2.0	2.3	2.4	2.8	3.0	3.4	3.6	4.1	4.4	5.0	5.4	6.1
40	-	-	-	-	-	-	2.0	2.3	2.4	2.8	3.0	3.4	3.7	4.2	4.5	5.1	5.5	6.2	6.7	7.5
50	-	-	-	-	2.0	2.3	2.4	2.8	3.0	3.4	3.7	4.2	4.6	5.2	5.6	6.3	6.8	7.6	8.4	9.4
63	-	-	-	-	2.5	2.9	3.0	3.4	3.8	4.3	4.7	5.3	5.8	6.5	7.0	7.8	8.6	9.6	10.5	11.7
75	2.0	2.3	2.3	2.7	2.9	3.3	3.6	4.1	4.5	5.1	5.6	6.3	6.9	7.7	8.4	9.4	10.2	11.4	12.5	13.9
90	2.2	2.6	2.8	3.2	3.5	4.0	4.3	4.9	5.3	6.0	6.7	7.5	8.2	9.2	10.0	11.1	12.2	13.6	15.0	16.6
110	2.7	3.1	3.4	3.9	4.3	4.9	5.3	6.0	6.5	7.3	8.1	9.1	10.0	11.1	12.3	13.7	14.9	16.5	18.4	20.4
125	3.1	3.6	3.8	4.3	4.9	5.5	6.0	6.7	7.4	8.3	9.2	10.3	11.4	12.7	13.9	15.4	16.9	18.7	20.9	23.1
140	3.5	4.0	4.3	4.9	5.4	6.1	6.7	7.5	8.3	9.3	10.3	11.5	12.8	14.2	15.6	17.3	19.0	21.0	23.4	25.9
160	4.0	4.5	4.9	5.5	6.2	7.0	7.7	8.6	9.5	10.6	11.8	13.1	14.6	16.2	17.8	19.7	21.7	24.0	26.7	29.5
180	4.4	5.0	5.5	6.2	7.0	7.8	8.6	9.6	10.6	11.8	13.3	14.8	16.4	18.2	20.0	22.1	24.4	27.0	30.0	33.1
200	4.9	5.5	6.1	6.9	7.7	8.6	9.6	10.7	11.8	13.1	14.8	16.4	18.2	20.2	22.3	24.7	27.1	30.0	33.4	36.9
225	5.5	6.2	6.9	7.7	8.7	9.7	10.8	12.0	13.3	14.8	16.6	18.4	20.5	22.7	25.0	27.6	30.5	33.7	37.5	41.4
250	6.1	6.9	7.6	8.5	9.7	10.8	12.0	13.3	14.8	16.4	18.4	20.4	22.8	25.2	27.8	30.7	33.8	37.3	41.7	46.0
280	6.9	7.7	8.5	9.5	10.8	12.0	13.4	14.9	16.5	18.3	20.6	22.8	25.5	28.2	31.2	34.5	37.9	41.8	46.7	51.5
315	7.7	8.6	9.6	10.7	12.2	13.6	15.0	16.6	18.6	20.6	23.2	25.7	28.7	31.7	35.0	38.6	42.6	47.0	52.5	57.9
355	8.7	9.7	10.8	12.0	13.7	15.2	17.0	18.8	20.9	23.1	26.2	29.0	32.3	35.7	39.5	43.6	48.0	52.9	59.2	65.3

Table 4 *(Concluded)*

SDR →	SDR 41		SDR 33		SDR 26		SDR 21		SDR 17		SDR 13.6		SDR 11		SDR 9		SDR 7.4		SDR 6	
Grade ↓	Nominal Pressure (PN) Bar																			
PE 63	PN 2		PN 2.5		PN 3.2		PN 4		PN 5		PN 6		PN 8		-		-		-	
PE 80	PN 2.5		PN 3.2		PN 4		PN 5		PN 6		PN 8		PN 10		PN 12.5		PN 16		PN 20	
PE 100	PN 3.2		PN 4		PN 5		PN 6		PN 8		PN 10		PN 12.5		PN 16		PN 20		-	
	Wall Thicknesses																			
Nominal OD, d_n mm	e_{Min} mm	e_{Max} mm	e_{Min} mm	e_{Max} mm	e_{Min} mm	e_{Max} mm	e_{Min} mm	e_{Max} mm	e_{Min} mm	e_{Max} mm	e_{Min} mm	e_{Max} mm	e_{Min} mm	e_{Max} mm	e_{Min} mm	e_{Max} mm	e_{Min} mm	e_{Max} mm	e_{Min} mm	e_{Max} mm
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
400	9.8	10.9	12.2	13.6	15.4	17.1	19.1	21.2	23.6	26.1	29.5	32.6	36.4	40.2	44.5	49.1	54.1	59.7	66.7	73.5
450	11.0	12.2	13.7	15.2	17.4	19.3	21.5	23.8	26.5	29.3	33.1	36.6	41.0	45.2	50.0	55.1	60.9	67.1	75.0	82.6
500	12.2	13.6	15.2	16.9	19.3	21.4	23.9	26.4	29.5	32.6	36.8	40.6	45.5	50.2	55.6	61.3	67.6	74.5	83.4	91.9
560	13.7	15.2	17.0	18.8	21.6	23.9	26.7	29.5	33.0	36.4	41.2	45.5	51.0	56.2	62.3	68.7	75.7	83.4	93.4	102.9
630	15.4	17.1	19.1	21.2	24.3	26.9	30.0	33.1	37.1	41.0	46.4	51.2	57.3	63.2	70.0	77.1	85.2	93.9	105.0	115.6
710	17.4	19.3	21.6	23.9	27.4	30.3	33.9	37.4	41.8	46.1	52.3	57.7	64.6	71.2	78.9	86.9	96.0	105.7	118.4	130.4
800	19.6	21.7	24.3	26.9	30.8	34.0	38.1	42.1	47.1	52.0	58.9	64.9	72.8	80.2	88.9	97.9	108.2	119.2		
900	22.0	24.3	27.3	30.2	34.7	38.3	42.9	47.3	53.0	58.4	66.2	73.0	81.9	90.2	100.0	110.1	121.7	134.0		
1 000	24.4	27.0	30.4	33.6	38.5	42.5	47.7	52.6	58.9	64.9	73.6	81.1	91.0	100.2	111.2	122.5				
1 200	29.3	32.4	36.4	40.2	46.2	51.0	57.2	63.1	70.6	77.8	88.3	97.3	109.1	120.2						
1 400	34.2	37.8	42.5	46.9	53.9	59.4	66.7	73.5	82.4	90.8	103.0	113.4								
1 600	39.1	43.2	48.5	53.5	61.6	67.9	76.2	84.0	94.2	103.6	117.7	129.6								
1 800	44.0	48.5	54.6	60.2	69.3	76.4	85.8	94.5	105.9	116.6										
2 000	48.8	53.8	60.7	66.9	77.0	84.8	95.3	105.0	117.7	129.6										
2 250	54.9	60.5	68.2	75.2	86.6	95.4	107.2	118.1												
2 500	61.0	67.2	75.8	83.5	96.2	106.0	119.1	131.2												

NOTES

1 1 Bar = 0.1 MPa = 1 N/mm^2.

2 Tolerances on wall thicknesses are calculated from (0.1 e_{Min} + 0.1) mm rounded up to the next 0.1 mm.

3 For practical reasons, a minimum wall thickness of 2.0 mm is recommended.

4 All pressure ratings are calculated at 27 °C and rounded up to nearest pressure class.

5 Considering operational problems, maximum wall thickness of pipes is considered around 130 mm.

(*Page* 7, *clause* **8.3**) — Substitute the following for the existing clause:

‘8.3 Carbon Black Content and Dispersion

When tested from a composite sample of minimum three pipes, in accordance with IS 2530, the carbon black content shall be within 2.5 ± 0.5 percent. When tested from a composite sample of minimum three pipes, the carbon black dispersion shall meet the requirement of **5.4.6** of IS 7328.’

(*Page* 7, *clause* **8.7**) — Substitute the following for the existing clause:

‘8.7 Density

When tested from a composite sample of minimum three pipes as per IS 7328, the base (corrected) density of pipes shall be between 940 kg/m^3 and 960 kg/m^3 and the same shall not differ from the density of the resin as specified by the resin manufacturer by more than 3 kg/m^3.’

(*Page* 7, *clause* **8.8,** *line* 3) — Substitute ‘110 mm diameter and SDR 11’ for ‘110 mm Dia/SDR 11’.

(*Page* 7, *clause* **8.8**, Note) — Substitute the following for the existing note:

‘NOTE — If 110 mm and SDR 11 pipes are not being manufactured, test shall be carried out on the nearest, preferably higher size of SDR 11 pipe being manufactured. If pipe sizes only below 90 mm are manufactured, the test is not required, however, in such cases, a test certificate from the raw material (resin) supplier for establishing conformity to the above requirement for 110 mm and SDR 11 pipe shall be provided.’

(*Page* 7, *clause* **8.9**) — Substitute the following for the existing clause:

‘8.9 Tensile Properties

When tested in accordance with Annex H with test parameters as per Table 6, the yield strength and elongation at break shall be as follows:

a) Yield strength : 15 MPa, *Min*
b) Elongation at break : 350 percent, *Min*

(*Page* 7, *clause* **8.10**, *line* 4) — Delete the word ‘preferably’.

(*Page* 7, *clause* **8.10**) — Substitute the following for the existing clause:

‘**8.10** When subjected to test parameters as given below and tested in accordance with the procedure given in Annex E, the notched test specimens prepared from 110 mm SDR 11 pipe in accordance with Annex J shall show no signs of localized swelling, leakage or weeping and shall not burst during the prescribed test period.

Test Temperature *°C*	*Test Duration* h	*Internal Test Pressure, Min* *(or Induced Hoop Stress, Min)* MPa		
		PE 63	PE 80	PE 100
(1)	(2)	(3)	(4)	(5)
80 ± 1	500	0.64 (3.2)	0.8 (4.0)	0.92 (4.6)

8.10.1 If 110 mm SDR 11 pipes are not being manufactured, the test shall be carried out on the nearest higher size SDR 11 pipe being manufactured with test parameters as given in **8.10**.

NOTES

1 The test is applicable to pipes of wall thickness greater than 5 mm.

2 If pipe sizes only below 63 mm are manufactured, the test is not required, however, in such cases, the test certificate from the raw material (resin) supplier for establishing conformity to the above requirement for 110 mm and SDR 11 pipe will suffice.

3 In case SDR 11 pipes are not manufactured, the internal test pressure values shall be calculated using the formula given in **3.18** (considering pressure reduction coefficient, f_T as 1) for an induced hoop stress of 3.2 MPa, 4.0 MPa and 4.6 MPa for PE 63, PE 80 and PE 100 pipes, respectively.

(*Page* 8, *clause* **9.1.1**, *third sentence*) — Substitute the following for the existing sentence:

‘Even if no change is envisaged, type test shall be done at least once during the validity period as mentioned in **9.1.5**.’

[(*Page* 8, *clause* **9.1.5** (*see also* Amendment No. 1)] — Substitute the following for the existing:

‘**9.1.5** At the end of the validity period [normally one year for internal pressure creep rupture test at 27 °C for 100 h and internal pressure creep rupture test (hydrostatic resistance test) for joints at 80 °C for 48 h, five years for internal pressure creep rupture test (hydrostatic resistance test) at 80 °C for 1 000 h, and two years for all other type tests] or earlier, as may be necessary, the testing authority may call for fresh samples for type test for the purpose of type approval.’

[*Page* 8, *Table* 7, *Sl No*. (v), *col* 2] — Substitute ‘1 000 h’ for ‘1 000 h test’.

[*Page* 10, *clauses* **10.1.1** and **10.1.1.1** (*see also Amendment No*. 1)] — Substitute the following for the existing clauses:

‘**10.1.1** The marking on the pipe shall carry the following minimum information:

a) Manufacturer’s name/trade mark;
b) Pipe designation as per **6.1**; and
c) Lot number/Batch number containing information of date of manufacture.

10.1.1.1 The lot number/batch number shall include the details of production in the following manner:

Year	Month	Day	Machine No.	Shift
xxxx	xx	xx	xxx	x

’

(*Page* 10, *clauses* **10.2**) — Substitute the following for the existing clause:

‘**10.2 BIS Certification Marking**

PE pipe for water supply conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and each PE pipe for water supply may be marked with the Standard Mark.’

(*Page* 11, *clause* **B-2**) — Substitute the following for the existing clause:

‘A sample from the pipe shall be taken by use of a core drill directed radically through the pipe wall. In case of PE granules, the sample shall be taken in a manner to avoid voids. The diameter of the sample in both the above cases shall be just less than the inner diameter of the sample pan of the thermal analyzer, and care should be taken not to overheat the sample during the coring/cutting operation. Using a scalpel, cut the test pieces that weigh 15 ± 0.5 mg in the form of discs from the inner and outer surfaces of the cored sample. These samples are to be tested with the original surface facing upward.

NOTE — If the purchaser wants to check the characteristics of the base material, the sample should be obtained by cutting a middle-section disc by removing the outer and inner surfaces.’

(*Page* 11, *clause* **B-3**, *para* 1, *line* 4) — Insert ‘,’ between ‘made’ and ‘the’.

(*Page* 12, *clause* **B-3**, *para* 2, *line* 2) — Insert ‘and’ between ‘pan’ and ‘an’.

(*Page* 12, *clause* **B-3**, *para* 2 and *para* 3) — Substitute ‘thermogram’ *for* ‘thermograph’.

(*Page* 16, *clause* **G-1**, *para* 2, *first sentence*) — Insert the following sentence at the end:

'A ductile failure will be the one which is a gradual failure with significant plastic deformation before rupture. A brittle failure will be the one with abrupt/sudden failure.'

[*Page* 20, *Table* 14, *Sl No.* (iv), *col* 4] — Substitute '6 ± 0.4' *for* '6+0-0.4'.

(*Page* 19, *Annex* H, *Title*) — Substitute the following for the existing title:

'DETERMINATION OF YIELD STRESS AND ELONGATION AT BREAK'.

[*Page* 22, *clause* **H-5**(a), *second sentence*] — Substitute the following for the existing sentence:

'Calculate the minimum initial cross-sectional area, *A*.'

[*Page* 22, *clause* **H-5**(d)] — Insert the following at the end:

'Also, record the load at yield point (steady load), *F*, which is the point from where the elongation of the test piece continues without any increase in the load.'

[*Page* 22, *clause* **H-6** (*see also Amendment No.* 1)] — Substitute the following for the existing clause:

'H-6 EXPRESSION OF RESULTS

H-6.1 Elongation at Break

Calculate, for each test piece, the elongation at break, using the following formula:

$$E = \frac{L_1 - L_0}{L_0} \times 100$$

Where,

E = elongation at break, expressed as a percentage;

L_0 = initial gauge length of the test piece, expressed in mm; and

L_1 = gauge length at rupture/break, expressed in mm.

The average value (arithmetic mean) of the elongation at break of the three test pieces shall be obtained and reported.

H-6.2 Yield Stress

Calculate for each test piece, the yield stress on the basis of the minimum initial cross-sectional area of the test piece, using the following formula:

$$\sigma_y = \frac{F}{A}$$

where,

σ_y = tensile stress at yield, in MPa;

F = force at yield, in N; and

A = minimum initial cross-sectional area of the test piece, in mm^2.'

NOTE — The yield stress should, in fact, be calculated using the cross-sectional area of the test piece at yield, but for reasons of convenience, the initial cross-sectional area is used.

The average value (arithmetic mean) of the tensile strength of the three test pieces shall be obtained and reported. The result should be expressed to three significant figures.'

(CED 50)

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